Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

The Pine Barrens community occurs primarily in sandy regions north of or along the ecoclimatic Tension Zone on sites with level to rolling topography. Soils are mostly sands or loamy sands and are low in nutrients with low water-retaining capacity. Historically the barrens vegetation occurred in areas of outwash sands and glacial lakebeds, but the community also occupied dune fields, sandspits, and broad river terraces. The most extensive Pine Barrens occurred in northwestern, central, west central, and northeastern Wisconsin on areas of glacial outwash or lakebed, but barrens also occurred in southwestern Wisconsin’s Driftless Area on some of the sand and gravel terraces that bordered the floodplains of the Mississippi, Wisconsin, Chippewa, and Black rivers.

Curtis’s estimate of Pine Barrens acreage at the time of Euro-American settlement was 2,349,000 acres—covering almost 7% of the state (Curtis 1959). At present only a few thousand acres are in good condition, with several thousand more that are potentially restorable.

Periodic wildfire was the dominant force that shaped and maintained Wisconsin’s Pine Barrens. Community structure and composition were highly variable, depending on the frequency, severity, and timing of the fires, topography, and position of natural firebreaks such as rivers and stream, lakes, and wetlands in the local landscape. Land use practices of the American Indian tribes was also an important factor in creating and maintaining barrens vegetation. Other disturbances affecting this community included periodic outbreaks of jack pine budworm (Choristoneura pinus), ice and hail storms, and windthrow, all of which set the stage for future fires because they killed or defoliated trees thereby increasing the fuel load.

Pine Barrens is a globally rare natural community that supports many rare and declining native plants and animals. Wisconsin has major opportunities and a responsibility to manage, restore, and protect a significant area of barrens vegetation.

Community Description: Composition and Structure

From historic accounts, including various descriptive narratives, the surveyors’ notes in the federal public land survey of the mid-1800s, and a few photographs, it was clear that vegetation structure was dynamic and highly variable. Stands might appear virtually treeless and prairie-like or brushy, supporting a significant area of barrens vegetation. Other disturbances affecting this community included periodic outbreaks of jack pine budworm (Choristoneura pinus), ice and hail storms, and windthrow, all of which set the stage for future fires because they killed or defoliated trees thereby increasing the fuel load.

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The dominant tree in the Pine Barrens was jack pine (Pinus banksiana), a species that sometimes grew in dense, even-aged stands, but northern pin oak (Quercus ellipsoidalis) and red pine (Pinus resinosa) were common associates. In some stands, they were the prevalent trees. Red pine is capable of achieving great longevity and size and could form park-like savannas with huge, widely spaced trees. Such sites were quickly exploited and the trees removed as Euro-American settlers moved into the state during the 19th century. Other trees associated with the pine barrens community included bur oak (Quercus macrocarpa), white oak (Q. alba), black oak (Q. velutina), black cherry (Prunus serotina), big-tooth aspen (Populus grandidentata) and quaking aspen (P. tremuloides). Eastern white pine (Pinus strobus) could be a component of barrens where a local seed source was present, and it is becoming increasingly common in stands from which fire has been excluded for long periods of time. In many settings, the "recovery" of eastern white pine, a species of high value that was decimated across the Upper Midwest during the Cutover of the late 18th and early 19th centuries, is desirable, laudable, and appropriately encouraged. However, in a barrens restoration and management situation, the dense shade cast by this species, its longevity, and great size can discourage, diminish, or eliminate the very species and vegetation structures managers are trying to encourage or recreate.

Pines in general are now reduced in abundance or even absent from some remnants. This is due to past logging,
Pine barrens remnant in the Northwest Sands Ecological Landscape in southern Douglas County features a scattering of large pines, thickets of deciduous shrubs, and openings composed mostly of native prairie grasses and forbs. This site is managed with prescribed fire. Photo by Eric Epstein, Wisconsin DNR.

A scattering of small jack pines interspersed with openings rich in native prairie plants and animals characterizes this pine barrens in the Central Sand Plains Ecological Landscape, eastern Jackson County. This site was within an area that was burned by a large wildfire in the mid-1970s. Photo by Eric Epstein, Wisconsin DNR.

frequent hot fires at short intervals of only a few years, the absence of a seed source, or some combination of these factors.

Structurally, this community is characterized by scattered pines (as individuals or groves) interspersed with openings in which small trees, shrubs, and a diverse assemblage of herbs dominate. Areas subjected to hot, frequent fires appear as almost treeless “grasslands.” Where frequent ground fires of low intensity were more characteristic, stands exhibited a more classic savanna physiognomy, with scattered, large, well-spaced trees. Catastrophic crown fires led to the development of dense stands of even-aged jack pine. The fires removed surface litter, exposed mineral soil, released nutrients, and created an appropriate bed as the serotinal cones of the jack pine opened and shed their seeds. Areas dominated by denser growths of oaks could quickly become thickets under a burn regime of catastrophic fire, due to the sprouting capabilities of the oaks.

Shrub and sapling density varied with fire regime and topography. In some managed stands, prescribed fire is applied at short intervals of three to five years. Where these stands had previously developed into oak forests with high canopy cover, oak grubs (sprouts) 1 to 3 meters high are now the dominant woody plants. Pines are scarce or may be entirely absent. Important shrubs include American hazel (Corylus americana) and beaked hazel (C. cornuta), prairie willow (Salix humilis), pin cherry (Prunus pensylvanica), sand cherry (P. pumila), prairie red-root (Ceanothus herbaceus), New Jersey tea (C. americanus), common dewberry (Rubus flagellaris), roses (Rosa spp.), and serviceberries (Amelanchier spp.).

The characteristic low shrubs include a group from the heath family, the Ericaceae. Examples are early low blueberry (Vaccinium angustifolium), velvet-leaf blueberry (V. myrtillus), black huckleberry (Gaylussacia baccata), and bearberry (Arctostaphylos uva-ursi). Associates, which are not in the heath family but which frequently co-occur with this group, are sweet-fern (Comptonia peregrina) and false heather (Hudsonia tomentosa).

Among the herbs, plants associated with sand prairie are well represented, especially in stands close to or west of the Tension Zone. The grasses and sedges of the Pine Barrens include little blue-stem (Schizachyrium scoparium), June grass (Koeleria macrantha), needlegrass (Stipa spartea), big blue-stem (Andropogon gerardii), crinkled hair grass (Deschampsia flexuosa), several panic grasses (Dicanthelium spp.), running savanna sedge (Carex siccata), Great Plains flat sedge (Cyperus lupulinus), and Schweinitz's flat sedge (C. schweinitzii).

Other representative barrens herbs are bracken fern (Pteridium aquilinum), flowering spurge (Euphorbia corollata), western sunflower (Helianthus occidentalis), rough blazing star (Liatris aspera), hoary puccoon (Lithospermum canescens), hairy puccoon (L. caroliniense), spreading dogbane
Apocynum androsaemifolium), wild lupine (Lupinus perennis), wild bergamot (Monarda fistulosa), heath aster (Symphyotrichum ericoides), sky-blue aster (S. oolentangiense), frost aster (S. pilosum), prairie coreopsis (Coreopsis palmata), bird’s-foot violet (Viola pedata), sand violet (V. sagittata var. ovata), false-dandelion (Krigia biflora), fragrant cudweed (Gnaphalium obtusifolium), hairy hawkweed (Hieracium longipilum), starry false Solomon’s-seal (Maianthemum bicknellii), whorled loosestrife (Lysimachia quadrifolia), lace-leaved loosestrife (L. lanceolata), and the rock-roses; hoary frostweed (Helianthemum bicknellii) and long-branch frostweed (H. canadense). Forb diversity generally decreases from south to north across the range of Wisconsin’s barrens.

Among the rare plants found in Pine Barrens are dwarf milkweed (Asclepias ovalifolia), prairie flame-rape (Orobanche uniflora), one-flowered broom-rape (Orobanche uniflora), and sand violet.

Numerous rare, declining, or otherwise limited animals are strongly associated with barrens (Kirk 1996), including two federally endangered animals, the Karner blue butterfly (Lycaenides melissa samuelis) and Kirtland’s Warbler (Setophaga kirtlandii). Noteworthy vertebrates are the Eastern Whip-Poor-Will (Antrostomus vociferous), Common Nighthawk (Chordeiles minor), Sharp-tailed Grouse (Tympanuchus phasianellus), gophersnake (Pituophis catenifer), prairie skink (Plestiodon septentrionalis), and Blanding’s turtle (Emydidae blandingii). The adult Blanding’s use sandy barrens habitats adjoining lakes, ponds, marshes and sedge meadows as breeding sites.

In addition to the Karner blue butterfly, rare invertebrates include phlox moth (Schinia indiana), frosted elfin (Callophrys irus), Henry’s elfin (C. henrici), Persius duskywing (Erynnis persius), and the northern barrens tiger beetle (Cicindela patrula patrula). If the exceedingly rare dwarf bilberry (Vaccinium caespitosum) is present, the equally rare northern blue butterfly (Lycaenides [=Plebejus] idas) might also be found (and vice versa).

Fossorial mammals such as the American badger (Taxidea taxus), plains pocket gopher (Geomys bursarius), eastern mole (Scalopus aquaticus), and the rare Franklin’s ground squirrel (Spermophilus franklinii) excavate burrows and create areas devoid of vegetation that are used by habitat specialists including some annual plants and invertebrates.

Conservation and Management Considerations
Wisconsin has some of the best opportunities across the North American range of the Pine Barrens to protect, manage, and maintain this globally rare natural community. Some of the largest, most diverse, and most viable remnants occur on public lands, where restoration and management activities are already underway in several locations. Many of the most sensitive native plants and animals dependent on barrens habitats are still present at one or more of these sites. It should be noted that the “barrens” of the northeastern United States (e.g., the “New Jersey Pine Barrens”) are also critically important from a conservation perspective but represent a very different ecosystem, almost entirely lacking the suite of sensitive plants and animals present in the barrens of the Upper Midwest, especially the prairie species.

To accommodate some of the more scale-dependent, area-sensitive animals, coordination between managers and agencies will be essential, especially where sites with the highest management potential overlap administrative jurisdictions. More attention to landscape-scale factors is needed, and it should be possible at some sites to expand the process used to design timber sales and prescribed burn plans to better maximize the amount and configuration of relatively open land available at any one point in time. See Swanson et al. (2011) for considerations that may be useful when planning management and examining alternatives for early successional communities (including the associated dry forests) in ways that will provide missing structural elements at multiple scales, better accommodate sensitive species associated with early successional communities, and avoid the tendency to either maintain certain stand structures at given locations in perpetuity or to replant dry forests immediately after harvest.

A caution for forest managers in the barrens regions is to avoid making the assumption that the more sensitive light-demanding flora will persist in a suppressed state through an entire rotation of the timber types often emphasized on former barrens sites. Recent studies have shown that at least some of these plants and associated animals can be lost, even after a single rotation of 50–70 years (Ralston and Cook 2013). To maintain the full spectrum of native plants and animals in such landscapes, it will be necessary to maintain the full spectrum of patch sizes and age classes that characterize a barrens-dominated landscape and to ensure that those patches are periodically connected.

Some confusion remains over the recognition of and values associated with barrens ecosystems, which have often
been treated as “forests” because they’re capable of supporting trees (Kotar et al. 2002). This remains a subject area for which educational efforts and better communications between interested parties are needed more than ever.

Significant threats to pine barrens communities are posed by continued fire suppression, conversion to plantation monocultures of conifers, use of herbicides that destroy the native flora along with deciduous brush, habitat fragmentation, prolonged or permanent stand isolation, and the spread of invasive species. Problematic invasive plants in Pine Barrens now include spotted knapweed (Centaurea biebersteinii), cypress spurge (Euphorbia cyparissias), leafy spurge (E. esula), orange hawkweed (Hieracium aurantiacum), Canada bluegrass (Poa compressa), Kentucky bluegrass (P. pratensis), and black locust (Robinia pseudoacacia).

In addition to the significant encroachment of woody plants and the increase in canopy cover and shade, dense sods of Pennsylvania sedge (Carex pensylvanica) now dominate the understories of some barrens. This is usually accompanied by a decline in floristic diversity. A problem facing managers and conservationists over the long term is how to encompass the structural variability inherent in this dynamic community both temporally and spatially. The tendency has been to manage individual stands as static entities in space and time. Other alternatives should be explored where the land base can accommodate management at larger scales and owners are on board.

Connection of remnants (firebreaks and utility or transportation corridors can sometimes accomplish this), at least periodically, is a critical need, especially for species whose populations have declined to low levels. Expansion of functional size is a priority conservation need, and this can be partially achieved by design at the time timber sales are planned for the surrounding forests. Small remnants exhibiting high floristic diversity remain important to identify, manage, and protect as so much barrens acreage has already been destroyed or degraded.

Rigid adherence to the percentage of tree cover is a poor way to define, evaluate, or develop a search image for this dynamic community. In addition, after a century of fire suppression, the vast majority of barrens vegetation will have succeeded to forest, typically with high canopy closure. Focusing attention on landforms, soils, disturbance history, and understory flora (especially in gaps or along open edges) will offer better clues to the existence of a barrens remnant or potential restoration site than simply looking at density of the tree canopy.

Additional Information

For information on related vegetation, see the natural community descriptions for Oak Barrens, Great Lakes Barrens, Sand Prairie, Sand Barrens, Northern Dry Forest, and Bracken Grassland. The U.S. National Vegetation Classification type corresponding most closely to Wisconsin’s Pine Barrens community is CEGL002490 Jack Pine / Prairie Forbs Barrens (Faber-Langendoen 2001).

Also see:
Borgerding et al. (1995)
Daijiang and Waller (2015)
Gregg and Niemuth (2000)
Grossman and Mladenoff (2007)
Heikens and Robertson (1994)
Houseman and Anderson (2002)
Kirk (1996)
Mossman et al. (1991)
Niemuth and Boyce (1998)
Niemuth and Boyce (2004)
Pregitzer and Saunders (1999)
Radeloff et al. (1999)
Radeloff et al. (2000)
Radeloff et al. (1998)
Ralston and Cook (2013)
Reetz et al. (2013)
Thomson (1940)
Vogl (1970)
Vora (1993)
WDNR (2011b)


For a list of terms used, please visit the Glossary.

For a reference list, please see the Literature Cited.